C2 Sub D2

5. (Once Amended) The composite reverse membrane according to claim 1, wherein the sodium chloride rejection is at least 98% and the water permeability is at least 0.6 m^3/m^2day when evaluated by using feed water which has pH 6.5, 0.05 weight % of salt, an operation pressure of 5kgf/cm^2 and a temperature of 25°C.

REMARKS

Please reconsider this application in view of the following remarks.

I. Disposition of Claims

Claims 1-3 and 5 are pending in the present application. Claims 1-3 and 5 currently stand rejected under 35 U.S.C. § 103.

II. Rejections under 35 U.S.C. § 103

The Examiner rejected claims 1-3 and 5 under 35 U.S.C. § 103, as being obvious over EP 0316525 (Fibiger) or U.S. Patent No. 4,872,984 ('984 patent). This rejection is respectfully traversed.

The Applicant's invention relates to a composite reverse osmosis membrane comprising a porous support, a polyamide skin layer formed on the support, wherein the contact angle between the polyamide skin layer surface and water is no more than 45°, the salt rejection is at least 98% and the permeate flow rate is at least 0.5 m^3/m^2day when evaluated by using feed water which has pH 6.5, 0.05 weight percent salt, and an operation pressure of 5 kgf/cm^2 at a temperature of 25°C. *See* Claim 1. Advantageously, the Applicant's invention also has a *sodium chloride* rejection of at least 98%, as supported, for example, by Example 1 of the present

invention. While other salts may be present in the feed water, the Applicant's invention advantageously removes at least 98% of the sodium chloride present in the feed water, as is recited in amended claim 1.

A. Fibiger and the '078 Patent

Applicant notes that the measurement results for membrane performance were obtained in Fibiger under a condition of 0.2% NaCl and 225 psi (15.8 kgf/cm^3), while measurements were obtained for the present invention, as recited in claim 1, under a condition of 0.05% NaCl and 5 kgf/cm^3. In the response dated August 22, 2001, the Applicant noted that the permeate flow rate described in the present invention under a condition of 0.05% NaCl water and 5 kgf/cm^2 corresponds to a permeate flow rate of 1.54 m^3/m^2d under the conditions described in Fibiger. In the Office Action of November 3, the Examiner requested that the Applicant explain how this conclusion was reached. Accordingly, the Applicant provides the following description of the mathematical calculation.

A permeate flow rate of a reverse osmosis membrane is proportional to a pressure obtained by subtracting an osmotic pressure from an operating pressure. This can be represented by the following equation:

$$Jv = Lp(\Delta P - \Delta\pi)$$

where Jv is the permeate flow rate, Lp is the permeate coefficient, ΔP is the effective pressure, and $\Delta\pi$ is the difference in osmotic pressure. In a test using a flat membrane (as done here), pressure loss is insignificant such that ΔP equals the pressure of the feed solution. Further, in the present application, the reverse osmosis membranes used both have a high rejection and

therefore, $\Delta\pi$, which denotes the difference in osmotic pressure between membranes, can be regarded as equivalent to the osmotic pressure of the feed solution.

Accordingly, the permeate flow rate is proportional to the difference between the pressure of the feed solution and the osmotic pressure of the feed solution. For example, when converting the value of a permeate rate determined as a feed solution of 0.2% NaCl at an operational pressure of 225 psi (15.8 kgf/cm^2) to a value determined using as a feed solution 0.05% NaCl at an operational pressure of 5 kgf/cm^2 as in the present invention, the calculation is as follows (noting that the osmotic pressure of 0.2% NaCl is 1.6 kfg/cm^2, and the osmotic pressure of 0.05 NaCl is 0.4 kgf/cm^2):

Permeate Rate F1 [0.05% NaCl, 5 kgf/cm^2] =

= Permeate Rate F2 [0.2% NaCl, 15.8 kgf/cm^2] x (5-0.4) / (15.8 - 1.6)

= Permeate Rate F2 [0.2 NaCl, 15.8 kgf/cm^2] x 0.324

Therefore, taking the Applicant's claimed flow rate of at least 0.5 m^3/m^2d (F1 above) and dividing by 0.324 results in a flow rate (shown as F2 above) of 1.54 m^3/m^2d. In contrast, the highest permeate flow rate disclosed by Fibiger is 1.3 m^3/m^2d (as shown in Example 13). Therefore, the Applicant respectfully disagrees with the Examiner's assertion that Fibiger discloses a permeate flow rate overlapping the Applicant's claimed range. Accordingly, the Applicant respectfully asserts that the Examiner has failed to make a prima facie case for obviousness, and asks that the rejection be withdrawn.

In addition, the Applicant notes that the Examiner correctly asserts that Applicant's original claims did not specify that the sodium chloride rejection is at least 98%. Accordingly,

claim 1 has been amended to specify the sodium chloride rejection rate, which is how the claims were meant to originally read. On page 11, lines 14-16, Fibiger states "[i]t is noteworthy that the sodium chloride rejection of both membranes is much lower than the magnesium sulfate rejection." Specifically, Fibiger discloses a sodium chloride rejection of 53-62%, in contrast to the Applicant's disclosure of at least 98%. The Applicant can find no disclosure in Fibiger that suggests or shows a salt rejection level of at least 98%, when the salt is sodium chloride. Tables 4 and 9 in Fibiger both include sodium chloride rejection levels which fall short of the Applicant's claimed salt rejection level of 98%. Because Fibiger does not suggest or show a general salt rejection level of 98%, but is rather limited to magnesium sulfate, Fibiger does not show or suggest the Applicant's claimed range.

Further, the Applicant notes that the Examiner has maintained the assertion that modifying the water contact angle is well known in the art. The Applicant respectfully disagrees with the Examiner's assertion that modifying the water contact angle in the case of reverse osmosis membranes is well known in the art. First, the Applicant notes that the '078 patent does not disclose modifying the water contact angle in the case of reverse osmosis membranes. The Applicant notes that given the unpredictable nature of chemical reactions and polymer properties in general, that the mere definition of a water contact angle provided by the '078 patent does not render claim 1 obvious. The '078 patent does not show or suggest altering the contact angle of a reverse osmosis membrane to improve salt rejection, as recited in claim 1 of the instant application. Rather, the '078 patent is simply defining the term hydrophilic when associated with a polymer or shaped polymer. Accordingly, the Applicant respectfully disagrees with the Examiner's characterization of the limitation of claim 1 as merely "discovering the optimum or

workable ranges." Should the Examiner maintain this rejection, the Applicant respectfully requests that the Examiner cite to prior art that shows modifying the water contact angle when using a reverse osmosis membrane. Alternatively, the Applicant requests that the Examiner provide an affidavit detailing the Examiner's personal knowledge pursuant to 37 C.F.R. 1.104(d)(2).

Based on the above arguments, the Applicant respectfully asserts that neither Fibiger nor the '078 patent, whether considered individually or in combination, render amended claim 1 of the instant application obvious. Specifically, Fibiger teaches away from the results claimed by the Applicant and does not disclose the claimed permeate flow rate. Claims 2, 3, and 5, which depend from amended claim 1, are likewise patentable.

B. The '984 Patent and the '078 Patent

The '984 patent relates to an interfacially synthesized reverse osmosis membrane useful for the separation of fluid mixtures and solutions. Again, the Applicant respectfully disagrees with the Examiner's assertion that the permeate flow rate disclosed by the '984 patent overlaps the Applicant's claimed permeate flow rate. In Applicant's Response dated August 22, the Applicant asserted that the highest permeate flow rate disclosed by the '984 patent is 26.3 gfd (in Example 23), while the Applicant's measurement conditions correspond to a permeate flow rate of 38 gfd. In the Office Action dated November 11, the Examiner requested an explanation of how this result was calculated. Accordingly, the Applicant provides the following mathematical description.

Using the permeate flow rate of 1.54 m^3/m^2d calculated above (noting that the '984 patent and Fibiger use the same operating conditions), the permeate flow rate may be converted

from cubic meters per square meter per day to gallons per square foot per day in the following manner:

1.54 m^3	264 gallons	1 square meter
m^2 x day	1 cubic meter	10.764 square feet

Based on this conversion chart, the Applicant's claimed range in gallons per square feet per day (gfd) is 1.54 multiplied by 264.173, divided by 10.764, which results in a value of 37.8, or 38 gfd as asserted by the Applicant. Therefore, the Applicant respectfully disagrees with the Examiner's assertion that the '984 patent discloses a permeate flow rate overlapping the Applicant's claimed range. Accordingly, the Applicant respectfully asserts that the Examiner has failed to make a prima facie case for obviousness, and asks that the rejection be withdrawn.

Furthermore, with respect to the Examiner's assertion that modifying the water contact angle is well known in the art, the Applicant reasserts the arguments set forth in the preceding section.

Based on the above arguments, the Applicant respectfully asserts that neither the '984 patent nor the '078 patent, whether considered individually or in combination, render claim 1 of the instant application obvious. Specifically, the '984 patent does not disclose the claimed permeate flow rate, while the '078 patent does not show or suggest modifying the contact angle in order to improve the salt rejection properties of a reverse osmosis membrane. Claims 2, 3, and 5, which depend from amended claim 1, are likewise patentable.

VII. Conclusion

Claims 1-3 and 5 have been shown to be allowable over the prior art. The amendments are believed to require no further prior art search. Because the amendments simplify the issues for allowance or appeal, and do not constitute new matter, entry thereof is respectfully requested. Applicant believes that this paper is responsive to each and every ground of rejection cited by the Examiner in the Action dated November 5, 2001, and respectfully requests favorable action in the form of a Notice of Allowance.

Please apply any charges not covered, or any credits, to Deposit Account 50-0591 (Reference No. 04558.039001).

Respectfully submitted,

Date: 3/4/02

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APPENDIX A: MARKED UP VERSION OF THE CLAIMS

1. (Twice Amended) A composite reverse osmosis membrane comprising:
a porous support; and
a polyamide skin layer formed on the porous support, wherein the contact angle between the polyamide skin layer surface and water is no more than 45°, sodium chloride **[the salt]** rejection is at least 98%, and the permeate flow rate is at least 0.5 m^3/m^2day when evaluated by using feed water which has pH 6.5, 0.05 weight % of salt, an operation pressure of 5kgf/cm^2 and a temperature of 25°C.

5. (Once Amended) The composite reverse membrane according to claim 1, wherein the sodium chloride **[salt]** rejection is at least 98% and the water permeability is at least 0.6 m^3/m^2day when evaluated by using feed water which has pH 6.5, 0.05 weight % of salt, an operation pressure of 5kgf/cm^2 and a temperature of 25°C.